

# Chapter 3

## New Instrument Approach Procedures

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Substantial increases in capacity can best be achieved through construction of new airports and new runways at existing airports. However, large projects like these require extensive long-term planning. In an effort to meet the increasing demands on the airport and airspace system in the near-term, the FAA has initiated improvements in air traffic control procedures designed to increase utilization of multiple runways and provide additional capacity at existing airports, while maintaining the current level of safety in aircraft operations.

In FY91, more than half of all delays were attributed to adverse weather conditions. These delays are in part the result of instrument approach procedures that are much more restrictive than the visual procedures in effect during better weather conditions. Much of this delay could be eliminated if the approach procedures used during instrument meteorological conditions (IMC) were closer to those observed during visual meteorological conditions (VMC).

During the past few years, the FAA has developed new, capacity-enhancing approach procedures. In most cases, these are multiple approach procedures aimed at increasing the number of airports and runway combinations that can be used simultaneously, either independently or dependently, in less than visual approach conditions.<sup>1</sup> “Independent” procedures are so called because aircraft arriving along one flight path do not affect arrivals along another flight path. “Dependent” procedures place restrictions on the various arrival streams of aircraft, because their proximity to each other has the potential to cause interference. The testing of these new procedures has been thorough, involving various validation methods, including real-time simulations and live demonstrations at selected airports.

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1. In general, depending on the airport aircraft mix, single-runway IFR approach procedures allow about 29 arrivals per hour. Hence, two simultaneous approach streams, when operating independently of each other, double arrival capacity to 57 per hour. Three streams would allow 86 hourly arrivals, and so on. Such procedures are called “independent,” because the arriving aircraft in one stream do not interfere with arrivals in the other. Conversely, “dependent” procedures place restrictions between the aircraft streams, and, as a result, hourly capacity for dual dependent approaches is somewhere between 29 and 57 arrivals. In the case of dependent triple streams, the arrival capacity is somewhere between 57 and 86, depending on airport runway configurations.
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In the past year, several new national standards have been published that incorporate some of these capacity-enhancing approach procedures.

- Simultaneous (independent) parallel approaches using the Precision Runway Monitor (PRM) to runways separated by 3,400 to 4,300 feet — published November 1991.
- Improved dependent parallel approaches to runways separated by 2,500 to 4,299 feet that reduce the required diagonal separation from 2.0 to 1.5 nm — published June 1992.
- Reduced longitudinal separation on wet runways from 3 to 2.5 nm inside the final approach fix (FAF) — published June 1992.
- Dependent converging instrument approaches using the Converging Runway Display Aid (CRDA) — published November 1992. The ARTS IIIA CRDA software upgrade is available now for installation.
- Simultaneous operations on wet intersecting runways — scheduled for publication late 1993.
- Use of Flight Management System (FMS) computers to transition aircraft from the en route phase of flight to existing charted visual flight procedures (CVFP) and ILS approaches — published December 1992.

The following sections present a brief description of these recently approved procedures and of the most promising approach concepts being developed, including their estimated benefits, supporting technology, and candidate sites that might benefit from the new procedures. The busiest 100 airports are listed in Table 3-3 (described in Section 3.8), together with the new procedures that each can potentially use. Site specific analysis is needed to determine which procedures are most beneficial to each airport.

### 3.1 Wake Vortex Restrictions

Wake vortex hazards limit aircraft spacing and, hence, the arrival and departure capacities of airports. Better understanding of the properties of wake vortices and of aircraft response to them will result in reduced separation standards based on measured data. They will also allow the development of a wake vortex alerting system based on meteorological data. These developments would make possible reduced in-trail and departure separation and could possibly reduce the minimum spacing required between parallel runways for dependent parallel operations.

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Recent efforts have helped improve the understanding of wake vortices by obtaining the wake vortex signatures of B-757 and B-767 aircraft and by measuring the characteristics of wake vortices under varying meteorological conditions. However, much more research is required before wake vortex associated spacing criteria can be revised.

### 3.2 Improved Longitudinal Separation on Wet Runways

Air traffic control procedures include minimum longitudinal separation standards for aircraft in approach streams inside the final approach fix (FAF). The separation distances vary from 2.5 to 6 nm, depending on the relative sizes of the leading and trailing aircraft. The minimum separations are intended to protect the trailing aircraft from the leading aircraft wake vortices. The minimum separation is also set to avoid situations in which the trailing aircraft lands before the leading aircraft has exited the runway.

In 1986, the FAA implemented a procedure that allowed a reduction of separation inside the FAF from 3 nm to 2.5 nm, provided that the runways were clear and dry and the runway occupancy time was 50 seconds or less. An effort was then undertaken to determine if the procedure could be used for arrivals on wet runways. Studies conducted in 1989 at Atlanta Hartsfield International Airport and Dallas-Fort Worth International Airport indicated that wet runway occupancy times are the same or less than dry runway occupancy times.

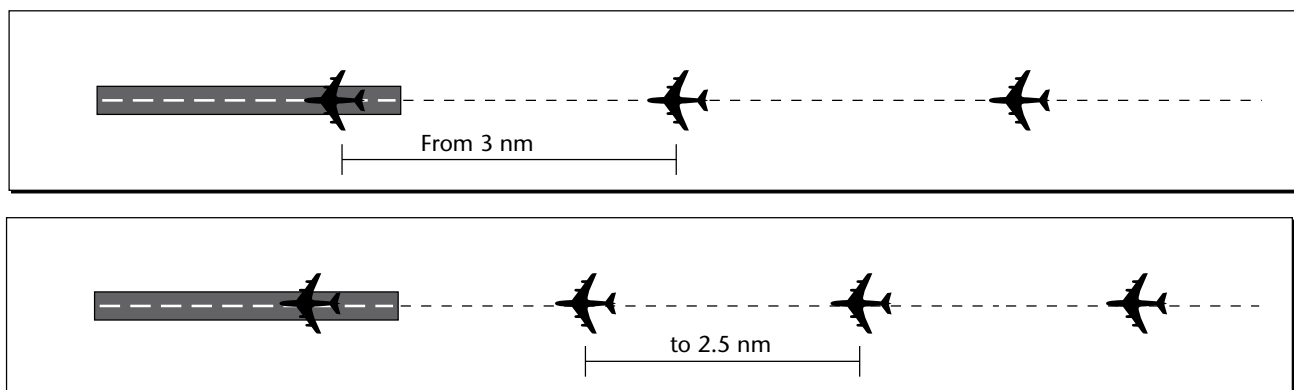
The FAA then initiated demonstrations at selected airports to determine the feasibility of allowing reduced longitudinal separation inside the FAF when runways are wet. Due to the success of the demonstrations, the FAA amended the national standard in June 1992 to allow reduced in-trail separation of 2.5 nm when runways are wet, and this new minimum separation was extended to a point 10 nm from the airport. The average capacity gain expected from this improvement is 3 to 5 arrivals per hour.

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#### Improved Longitudinal Spacing on Wet Runways



### 3.3 Parallel Instrument Approaches

Currently, the separation between parallel runways must be at least 4,300 feet for simultaneous independent operations and at least 2,500 feet for dependent parallel operations. The FAA is actively pursuing ways to reduce the runway spacing required for independent operations to as low as 2,500 feet. The FAA recently approved a procedure to increase the capacity of dependent runway configurations by reducing the required diagonal separations between aircraft on adjacent runways.

#### 3.3.1 Independent Parallel Instrument Approaches Using Current Radar Systems

Since 1962, the FAA has authorized independent (simultaneous) instrument approaches to dual runways, doubling the arrival capacity of an airport in IMC. Initially, the spacing between the parallel runways was required to be at least 5,000 feet, but, in 1974, this was reduced to 4,300 feet. More than 15 U.S. airports are currently authorized to operate such independent parallel instrument approaches.

Several airports today would benefit from the additional capacity that would result from simultaneous approaches to three or more runways. The use of triple parallel approaches in IFR conditions would result in a 50 percent increase in arrival capacity, and quadruple parallel approaches, a 100 percent increase compared to dual independent approaches.

Dallas-Fort Worth and the new Denver International Airport are planning to build parallel runways that will give them the capability to conduct triple and quadruple independent parallel approaches. Simulations at the FAA Technical Center in 1988 and 1989 resulted in site-specific approval of triple and quadruple simultaneous parallel approaches at Dallas-Fort Worth. This approval is contingent upon construction of Runway 16L 5,000 feet from and parallel to Runway 17L, and Runway 16R 5,800 feet from and parallel to Runway 18R.

The success of the Dallas-Fort Worth simulations has led to further simulations to develop generic procedures and standards to allow independent parallel approaches at the closest runway spacing at levels of safety equivalent to or better than current approaches. National standards for triple and quadruple independent parallel approaches are under development. These standards are expected to

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require a minimum of 5,000 feet between the runways when using the current radar systems. New technology, such as high-update-rate radars or improved controller displays, will allow reduced runway spacings. Such configurations are also being simulated at the FAA Technical Center.

At some airports, combinations of independent parallel and converging instrument approaches could be used to implement triple and quadruple independent approaches with multiple departure streams. Dallas-Fort Worth has an existing configuration for such triple approaches, using two parallel and one converging runways, as does Chicago O'Hare. Work is currently underway to develop procedures to optimize the use of such runways using the current radar systems.

### **3.3.2 Independent Parallel Instrument Approaches Using a Precision Runway Monitor**

The flexibility inherent in having two independent arrival streams provides a significant advantage relative to the dependent arrival case in which diagonal separations must be maintained. It can increase the number of operations per hour from about 29 to 57. If the runways are spaced closer than 4,300 feet, independent approaches are made possible by the use of the Precision Runway Monitor (PRM) (described in Section 5.2.2) in place of the existing terminal radar and displays.

During 1990, demonstrations conducted at Memphis (MEM) and Raleigh-Durham (RDU) showed that independent parallel approaches to runways 3,400 feet apart are possible using this new radar display technology. As a result, procedures to allow independent approaches to parallel runways 3,400 feet apart using the PRM were published in 1991. The PRM will be developed into a production system to support these approaches. A contract was let in the spring of 1992 for procurement of five electronically scanned (E-Scan) PRM antenna systems. Delivery of these systems is planned for 1994.

The FAA conducted simulations at the FAA Technical Center of independent approaches down to 3,000 feet of runway spacing using the new technology. These simulations will help demonstrate the feasibility of conducting simultaneous parallel approaches to runways with centerlines as close as 3,000 feet.

Airports that might benefit from PRM implementation are listed in Table 3-1, segregated by runway separation. Included are the airports selected to receive the first five systems. The other airports are preliminary candidates only. Some of the candidate

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airports are currently able to operate independent parallel approaches. Therefore, PRM use would apply only if these airports stopped operating their largest-spaced runways (4,300 feet or more) and instead activated parallel runways that are closer to each other.

**Table 3-1. Candidate Airports for Independent Parallel Approaches Using the Precision Runway Monitor (PRM)**

Runway Separation of 3,400 to 4,299 ft.†	
Atlanta (SS)*	Phoenix
Baltimore (SS)*	Pittsburgh**
Detroit	Raleigh-Durham (SS)
Ft. Lauderdale	Salt Lake City
Memphis (SS)	Tampa
Milwaukee	
Runway Separation of 3,000 to 3,399 ft.†	
Denver (DIA)*	New York Kennedy
Harlingen	Philadelphia*
Long Beach	Portland
Minneapolis-St. Paul (SS)***	
Runway Separation of 2,500 to 2,999 ft.†	
Columbus	Indianapolis
Dallas-Love Field	
† - Some of the airports in each category may also have parallel runways with a different spacing category. However, airports are listed only one time under the spacing category most likely to be used, that is, runways with the largest spacing.	
* - Applicable upon construction of new runway(s).	
** - Runways are 5,540 ft. apart; a new runway is planned that will create a parallel set separated by 3,100 ft. or 4,300 ft.	
*** - Runways at MSP are 3,380 ft. apart; a waiver is required for PRM.	
SS - Selected site.	

### 3.3.3 Independent Parallel Instrument Approaches Using Final Monitor Aid (FMA)

At some airports, independent parallel instrument approaches to runways separated by less than the current standard could be used to implement triple or quadruple arrival streams with multiple departure streams. This concept applies primarily to airports that already have independent or dependent arrival streams to parallel runways. Additional parallel arrival streams would provide an increase of 50 percent for triples and 100 percent for quadruples compared to dual independent approaches.

National standards for triple and quadruple independent approaches are currently under development. The success of the Dallas-Fort Worth simulations of simultaneous independent parallel instrument approaches and the resulting procedures established have led to further simulations to develop generic procedures for independent parallel approaches. The goal is to develop procedures and standards that allow independent parallel approaches at the closest runway spacing at levels of safety equivalent to or better than current procedures.

As a part of the development of national standards, the FAA is also testing the effect of using the Final Monitor Aid (FMA) in independent approaches. The FMA consists of the color digital display and alert features of the PRM system, but it does not include the high-update-rate radar sensor. In these tests, the FMA is combined with existing or planned sensors that have a one to two milliradian accuracy and update rates of 4.8 seconds, consistent with current sensors. Use of the FMA with these existing sensors could improve the controller's ability to monitor parallel approaches at spacings less than the current standard without a PRM system (especially when compared to current analog displays), without the additional expense of the high-update-rate radar.

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Use of the FMA with existing sensors could improve the controller's ability to monitor parallel approaches at spacings less than the current standard without a PRM system.

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### 3.3.4 Dependent Parallel Instrument Approaches

Rules for dependent IFR operations were revised in June 1992. They now require a diagonal separation between aircraft on adjacent approaches of at least 1.5 nm, instead of the previous 2.0 nm, for parallel runways 2,500 to 4,299 feet apart. (Runways spaced 4,300 feet or more apart still require a diagonal separation of 2.0 nm.) This change was approved as a result of successful demonstration programs carried out in 1990 and 1991 showing that this diagonal separation can be safely changed for runways at least

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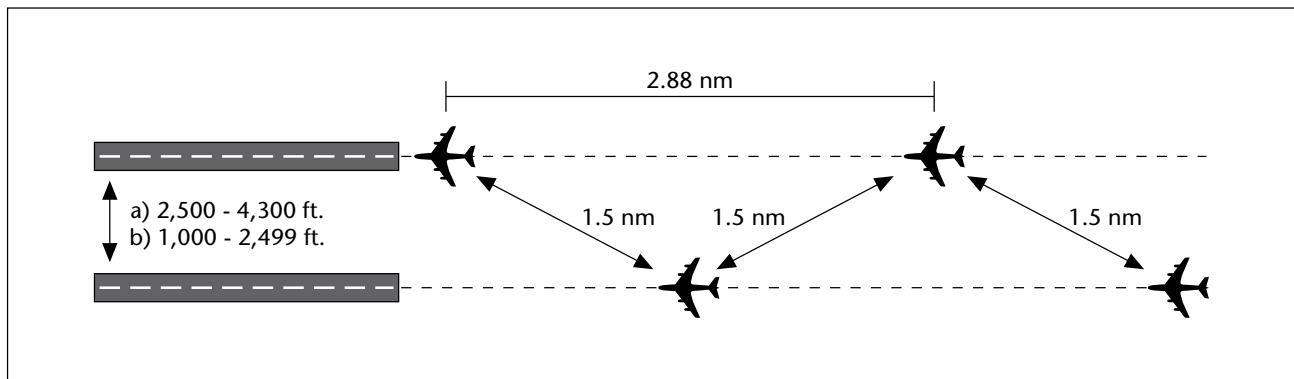
2,500 feet apart. This new spacing will permit approximately four additional arrivals per hour compared to 2.0 nm spacing.

A preliminary analysis has been made of the capacity gains that might be achieved by dependent operations on parallel runways 1,000 to 2,499 feet apart. The analysis has shown that arrival capacity increases of 46 to 65 percent are possible relative to single runway operations for diagonal separations of 1.5 and 2.0 nm between aircraft, respectively. Work is underway to validate these results and to determine whether such operations are feasible.

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**Dependent Parallel Instrument Approaches**

### 3.4 Converging Approaches

Converging runway approach improvements must take into account the wide variety of converging runway configurations that are in use. Numerous factors must be considered in designing approaches for a particular runway configuration. There is often a tradeoff between the minimum ceiling and visibility that can be achieved and the landing capacity, particularly in determining whether dependent or independent converging IFR approaches can be used. The FAA is actively pursuing ways to increase capacity for a wide variety of configurations while achieving the lowest possible landing minimums. At some airports it might be feasible to increase capacity at Category I landing minimums using technology that reduces the variability between successive operations. Procedural changes are being implemented that widen the range of weather conditions in which higher than previously achievable landing rates may be achieved for intersecting runways.

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Using technology that reduces the variability between successive operations is being considered to increase capacity at Category I landing minimums.

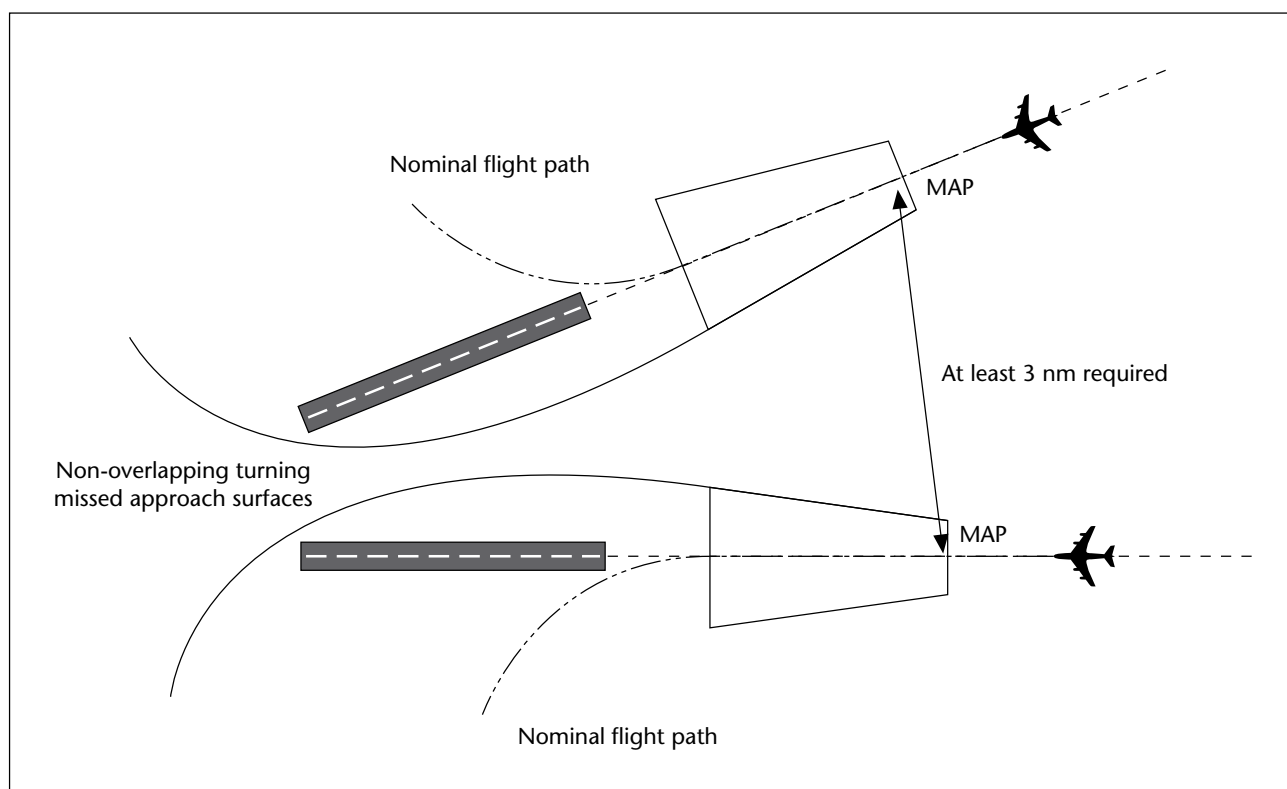
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### 3.4.1 Independent Converging Instrument Approaches

Under VFR, it is common to use converging runways for independent streams of arriving aircraft. Because of the reduced ceilings and visibility associated with operations under IFR, the FAA, in 1986, established a procedure for conducting simultaneous instrument approaches to converging runways in instrument meteorological conditions (IMC).

This procedure uses non-overlapping Terminal Instrument Procedures (TERPS) obstacle-clearance surfaces as a means of separation for aircraft executing simultaneous missed approaches. It assumes that each of the aircraft executing a turning missed approach can keep its course within the limits of its respective TERPS obstacle-free surface. Each of the two TERPS surfaces is drawn starting from the respective missed approach point (MAP). This procedure also requires a 3 nm separation between the MAPs on each approach. “TERPS+3” (as this procedure is often called) requires no dependency between the two aircraft on the converging approaches. Hence, it is an independent approach procedure.



**Independent Converging Instrument Approaches**

In order to keep the two MAPs 3 nm apart and ensure non-overlapping TERPS surfaces, the MAPs have to be moved back, away from the runway thresholds. This increases the separation between the TERPS surfaces and results in higher decision heights.

One limitation of this procedure, however, is that many runway configurations require decision heights greater than 600 feet in order to satisfy the TERPS+3 criteria. This restricts the application of the procedure to operations close to the boundary between VFR and IFR. The procedure cannot be used if the converging runways intersect, unless controllers can establish visual separation and the ceiling and visibility are at or above 700 feet and 2 statute miles.

Recently, the FAA has been investigating the impact of the 3 nm separation and the possibility of reducing it.

### 3.4.2 Dependent Converging Instrument Approaches

Typically, independent converging IFR approaches using the TERPS+3 criteria are feasible only when ceilings are above 600 feet, depending upon runway geometry. As an alternative precision approach procedure, dependent IFR operations could be conducted to much lower minima, usually down to Category I, thus expanding the period of time during which the runways can be used. However, in order to conduct these dependent operations efficiently, controllers need an automated method for ensuring that the aircraft on the different approaches remain safely separated. Without such a method, the separation of aircraft would be so large that little capacity would be gained.

A program was conducted at St. Louis (STL) to evaluate dependent operations using a controller automation aid, the Converging Runway Display Aid (CRDA) (also called ghosting or mirror imaging and described in Section 5.2.1.1), to maintain aircraft stagger on approach. National standards for this procedure were published in November 1992. It is estimated that capacity increases of approximately 10 arrivals per hour over single-runway operations are achievable with this procedure.

Airport surveys show that there is a high level of interest in the use of the CRDA at the 23 airports listed in Table 3-2. Not all of these airports would necessarily show a capacity benefit, however, because the surveys considered airport-specific needs, such as an improved noise impact, that might not be directly related to capacity.

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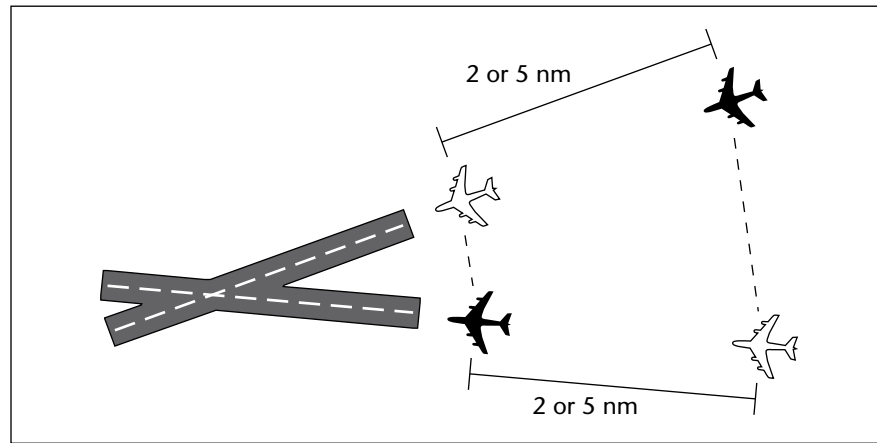
National standards for CRDA were published in November 1992. Capacity increases of approximately 10 arrivals per hour over single-runway operations are achievable using this controller automation aid.

CRDA may also have applications under VFR. It could be used at airports with intersecting runways that have insufficient length to allow hold short operations

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The CRDA concept may also have applications under VFR. For example, it could be used at airports with intersecting runways that have insufficient length to allow hold short operations. Insufficient runway length between the threshold and the intersection with another runway can be ignored if arrivals are staggered such that one is clear of the intersection before the other crosses its respective threshold.



**Dependent Converging Instrument Approaches Using CRDA**

**Table 3-2. Candidate Airports for Dependent Approaches Using the Converging Runway Display Aid (CRDA)**

Airports with a High Potential for Using the CRDA	
Baltimore	Minneapolis-St. Paul
Boston	New York Kennedy
Chicago Midway	New York La Guardia
Chicago O'Hare	Newark
Cleveland	Oakland
Dallas-Ft. Worth	Philadelphia
Dayton	Pittsburgh
Denver Stapleton	Portland
Houston Hobby	St. Louis
Memphis	Washington Dulles
Miami	Windsor Locks
Milwaukee	

### 3.4.3 Simultaneous Operations on Intersecting Runways (SOIR)

The FAA is currently investigating the capacity ramifications of a number of proposed changes governing simultaneous operations on intersecting runways (SOIRs). Aircraft are classified into one of six SOIR groups, which dictate the minimum landing distance that must be available in order for an aircraft in that group to be eligible to hold short. Proposed restructuring of these groups would more closely match the performance characteristics of aircraft by specifying minimum runway length requirements that differentiate between propeller and jet aircraft, between dry and wet runway conditions, and among different aircraft landing configurations.

Approved SOIRs, which include simultaneous takeoffs and landings and/or simultaneous landings, are authorized when a landing aircraft is able to and is instructed by the controller to hold short of the intersecting runway. Currently, SOIRs are permitted only on dry runways. Demonstrations of simultaneous operations on intersecting wet runways (SOIWR) conducted at Boston Logan, Greater Pittsburgh, and Chicago O'Hare airports have pointed out the viability of standardizing these operations. Procedural development is underway, and a national standard for simultaneous operations on wet runways will be issued in late 1993. Sixty of the top 100 airports currently conduct hold short operations and would be affected by these changes. The largest capacity benefits would be realized at airports where propeller aircraft use the hold short runway.

Currently, the runway length available on a hold-short runway is measured from the landing threshold to the intersecting runway edge along the landing runway edge closest to the intersecting runway or from the landing threshold to hold-short markings, lights, or signs when installed.

## 3.5 Simultaneous ILS and LDA Approaches

It is generally recognized that airport capacities in IMC are well below those achieved in VMC. However, once weather conditions fall below visual approach vectoring minima, even if conditions are still VFR, an airport whose parallel runways are separated by less than 2,500 feet generally has fewer options for conducting multiple approaches. For example, San Francisco International (SFO) uses Runways 28L and 28R about 85 percent of the time for simultaneous visual approaches. These runways are separated by 750 feet. Once the ceiling is less than 500 feet above the minimum vectoring altitude the airport is forced to go to a single runway operation

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Restructuring of the six SOIR groups to more closely match the performance characteristics of aircraft, differentiating between propeller and jet aircraft, between dry and wet runway conditions, and among different aircraft landing configurations, would improve capacity on hold short runways

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Procedural development is underway, and a national standard for simultaneous operations on wet runways will be issued in late 1993. Sixty of the top 100 airports would be affected by these changes.

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Procedures are being developed for instrument approaches to STL and SFO for parallel runways separated by less than 2,500 feet. They consist of an LDA approach to one parallel runway and an ILS approach to the adjacent parallel runway.

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because aircraft may no longer be vectored for visual approaches to both parallel runways.

A special solution to this problem has been developed and is in use at St. Louis Lambert Field (STL) (STL has parallel runways separated by 1,300 feet). It involves the use of a Localizer Directional Aid (LDA) approach to one parallel runway and an ILS approach to the adjacent parallel runway. The localizer is offset from the runway centerline to provide increased separation far from the runway. These approaches are conducted simultaneously and utilize the procedures and equipment associated with simultaneous parallel approaches to runways separated by at least 4,300 feet; however, the STL procedure also requires the use of visual separation at or prior to the point where the separation between the final approach courses reaches 4,300 feet (the missed approach point). The minimums for the LDA approach are as low as a 1,200 foot ceiling and 4 miles of visibility.

A similar procedure has been adopted at San Francisco for Runways 28R and 28L.

### **3.6 Flight Management System (FMS) Transition to Existing Approaches**

The FAA has developed a capacity enhancement initiative to demonstrate the use of FMS computers as a means of transitioning aircraft from the en route phase of flight to existing charted visual flight procedures (CVFP) and instrument landing system (ILS) approaches. The demonstration phase at San Francisco International Airport has been completed, and the procedure is now being used on a regular basis.

FMS procedures are expected to allow the reduction of minimums for CVFP and offer alternative arrival paths for FMS-equipped aircraft. Implementation of FMS-CVFP is being expanded to include other airports that can benefit from FMS-assisted flight path navigation. National standards were issued in late 1992.

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### **3.7 Independent and Dependent Approaches for Multiple Parallel Runways**

Procedures for conducting independent and dependent parallel approaches to three or more runways simultaneously do not currently exist. The result is that some existing airport configurations are not as efficient as they could be and some future airport designs become less attractive.

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Two runways whose centerlines are spaced 4,300 feet or more apart qualify for the use of independent approach procedures. However, a third parallel runway whose spacing is less than 4,300 feet does not qualify for the application of dependent parallel approach criteria. As such, controllers and pilots are unable to take advantage of a dependent approach that would allow them to support a third arrival stream and significantly increase the capacity of the airport.

The focus of this long-term effort is to allow a reduction to 1.5 nm diagonal spacing between aircraft operating on adjacent runways when centerline spacings are as close as 2,500 feet. This effort is particularly important to the planning and development of additional runways with reduced centerline spacings and offers the possibility of a viable alternative to siting and building completely new airports.

### 3.8 Approach Procedure Applicability at the Top 100 Airports

Table 3-3 shows the applicability of current and proposed procedures for the top 100 airports. The first column shows the current best hourly arrival capacity and the approach procedure utilized to achieve that capacity. The following columns show which of the proposed procedures discussed in the previous sections are applicable. It is important to bear in mind that this table is based on runway approach diagrams; factors such as noise, obstructions, and community concerns were not considered. Some airports may not be using their “current best” approach procedures. For these same reasons, the airports where the PRM might be applicable (Table 3-1) and where significant interest was shown for the CRDA (Table 3-2) are not identical to those shown in Table 3-3. In addition, the actual aircraft fleet mix at each airport was not used; the capacity figures are numbers which are reasonable approximations of real capacity, used for comparison only. The objective of the table is to provide initial information on the applicability of approach procedures being developed by the FAA.

An asterisk (\*) indicates that the proposed approach procedure in the column in question is applicable at a given airport, however, it also means that either the current best procedure, or another proposed approach procedure (under new rules), provides equal or better arrival capacity. A “p” indicates that the approach procedure may be applicable if and when proposed construction/extension plans actually take place. Some of this construction is in progress, and some is only at the proposal stage. A blank space indicates either that the runways do not support the proposed procedure, it is

a borderline application, or there is not enough information to determine applicability. Finally, in order to highlight new approach procedures that would provide better capacity than any other procedures (current or proposed), an asterisk was replaced by a capacity number wherever the new procedure can provide higher capacity than any other. The number indicates the hourly arrival capacity of the procedure in question. It is easy to identify the most beneficial improvement by looking at the “New Approach Procedure” section in each row.

**Table 3-3. Potential Siting of New IFR Approach Procedures and Their Associated IFR Arrival Capacity<sup>1</sup>**

Airport Location	Airport Code	Current Best IFR Arrival Capacity (App Procedure) <sup>2</sup>	New Approach Procedures				
			Dependent Parallel	Independent Parallel	CRDA	TERPS+3	Triples
Agana (Guam)	NGM	29 (S)					
Albany	ALB	29 (S)			34		
Albuquerque	ABQ	29 (S)					
Anchorage	ANC	29 (S)				57	
Atlanta	ATL	57 (IP)	*	*p			71p
Austin (new airport)	BSM	57 (IP)					
Baltimore	BWI	29 (S)		57p	*		
Birmingham	BHM	29 (S)					
Boise	BOI	29 (S)					
Boston	BOS	29 (S)	42		*		
Buffalo	BUF	29 (S)			34		
Burbank	BUR	29 (S)			34		
Charleston	CHS	29 (S)			34		
Charlotte	CLT	57 (IP)			*	*	86p
Chicago	MDW	29 (S)					
Chicago	ORD	57 (IP)				*	86
Cleveland	CLE	29 (S)			34		
Colorado Springs	COS	29 (S)		*p	*	57	
Columbia	CAE	29 (S)			34		
Columbus	CMH	42 (DP)		*		57	
Dallas	DAL	42 (DP)		57			
Dallas-Fort Worth	DFW	57 (IP)				*	86p
Dayton	DAY	57 (IP)			*	*	
Denver (new airport)	DIA	57 (IP)	*				86
Des Moines	DSM	29 (S)			34		
Detroit	DTW	57 (IP)	*	*		*	71p
El Paso	ELP	29 (S)	*			57	
Fort Lauderdale	FLL	29 (S)		57	*		
Fort Myers	RSW	29 (S)		57p			
Grand Rapids	GRR	29 (S)		57p			
Greensboro	GSO	29 (S)		57p	*		
Greer	GSP	29 (S)		57p			
Harlingen	HRL	29 (S)		*	*	57	
Hilo	ITO	29 (S)			34		
Honolulu	HNL	57 (IP)			*		
Houston Hobby	HOU	29 (S)			34		
Houston Intercont'l	IAH	57 (IP)				*	86p
Indianapolis	IND	42 (DP)			*		



**Table 3-3. Potential Siting of New IFR Approach Procedures and Their Associated IFR Arrival Capacity<sup>1</sup>**

Airport Location	Airport Code	Current Best IFR Arrival Capacity (App Procedure) <sup>2</sup>	New Approach Procedures				
			Dependent Parallel	Independent Parallel	CRDA	TERPS+3	Triples
Islip	ISP	29 (S)			34		
Jacksonville	JAX	29 (S)				57	
Kahului	OGG	29 (S)			34		
Kailua-Kona	KOA	29 (S)					
Kansas City	MCI	29 (S)		*p		57	
Knoxville	TYS	29 (S)	42				
Las Vegas	LAS	29 (S)			34		
Lihue	LIH	29 (S)			*	57	
Little Rock	LIT	57 (IP)					
Long Beach	LGB	29 (S)	*	57	*		
Los Angeles	LAX	57 (IP)					
Louisville	SDF	29 (S)		57p	*		
Lubbock	LBB	29 (S)					
Memphis	MEM	42 (DP)		*	*	57	
Miami	MIA	57 (IP)			*	*	
Midland	MAF	29 (S)	*		*	57	
Milwaukee	MKE	29 (S)	*	*	*	57	
Minneapolis-St. Paul	MSP	42 (DP)		57	*		
Nashville	BNA	57 (IP)	*		*		
New Orleans	MSY	29 (S)		*p		57	
New York Kennedy	JFK	42 (DP)		*	*	57	
New York La Guardia	LGA	29 (S)			34		
Newark	EWR	29 (S)			*	57	
Norfolk	ORF	29 (S)			34		
Oakland	OAK	29 (S)	*			57	
Oklahoma City	OKC	57 (IP)				*	
Omaha	OMA	29 (S)	42		*		
Ontario	ONT	29 (S)					
Orlando	MCO	57 (IP)	*				86p
Philadelphia	PHL	57 (IC)	*	*p	*		
Phoenix	PHX	29 (S)		57			
Pittsburgh	PIT	57 (IP)	*	*	*		71p
Portland, OR	PDX	42 (DP)		57	*		
Portland, ME	PWM	29 (S)			34		
Providence	PVD	29 (S)	42		*		
Raleigh-Durham	RDU	42 (DP)		*	*		71p
Reno	RNO	29 (S)			34		
Richmond	RIC	29 (S)				57	

**Table 3-3. Potential Siting of New IFR Approach Procedures and Their Associated IFR Arrival Capacity<sup>1</sup>**

Airport Location	Airport Code	Current Best IFR Arrival Capacity (App Procedure) <sup>2</sup>	New Approach Procedures				
			Dependent Parallel	Independent Parallel	CRDA	TERPS+3	Triples
Rochester	ROC	29 (S)			*	57	
Sacramento	SMF	57 (IP)					
Salt Lake City	SLC	42 (DP)		*		*	71p
San Antonio	SAT	29 (S)			*	57	
San Diego	SAN	29 (S)					
San Francisco	SFO	29 (S)			34		
San Jose	SJC	29 (S)					
San Juan	SJU	29 (S)				57	
Santa Ana	SNA	29 (S)					
Sarasota-Bradenton	SRQ	29 (S)					
Savannah	SAV	29 (S)		57p	*		
Seattle-Tacoma	SEA	29 (S)	42p				
Spokane	GEG	29 (S)		57p			
St. Louis	STL	29 (S)	*		*	57	
Syracuse	SYR	29 (S)		57p	*		
Tampa	TPA	57 (IP)		*	*	*	
Tucson	TUS	29 (S)					
Tulsa	TUL	57 (IP)			*		86p
Washington National	DCA	29 (S)			34		
Washington Dulles	IAD	57 (IP)				*	86p
West Palm Beach	PBI	29 (S)			34		
Wichita	ICT	57 (IP)				*	
Windsor Locks	BDL	29 (S)					

1. Generic (not airport-specific) capacities are used here to provide a basis of comparison only. These capacities, derived through the FAA Airfield Capacity Model, use a standard aircraft mix. Generally, runways not suitable for commercial operations were not considered. Also, factors such as winds and noise constraints are not taken into account.
  2. Current Best Approach Procedure Abbreviations:
    - DC - Dependent Converging Instrument Approaches
    - DP - Dependent Parallel runways
    - IC - Independent Converging runways
    - IP - Independent Parallel runways
    - S - Single runway
- An Asterisk (\*) indicates proposed new approach procedures applicable at the airport in question; however, it also means that either the current best procedure, or another proposed approach procedure (under new rules), provides equal or better arrival capacity.
  - A number indicates the hourly arrival capacity provided by a new approach procedure, when such capacity is larger than the one provided by other procedures (current or new), applicable at the airport in question.
  - A “p” indicates that the approach procedure will be applicable if and when planned runway construction/extensions take place at the airport in question.